

OXYGEN THERAPY AND PRESCRIPTION FOR PAEDIATRIC INPATIENTS

NEW ALL WALES PRESCRIPTION CHART
NOVEMBER 2014

Prescribing Oxygen for Paediatric Inpatients

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Background

Oxygen is regarded as a medicine and therefore cannot be administered by nursing staff without a prescription. ***This is a legal requirement.***

British Thoracic Society (BTS) Guidelines for Emergency Oxygen use in Adults (2008)

These guidelines indicate that oxygen for adult inpatients must be prescribed. There are currently no parallel guidelines for the management of children, but these are in the process of being developed and are likely to advocate the same.

The adult guideline provides guidance on the following principles:

- Defining target oxygen saturations for different patient groups
- Prescribing oxygen
- Monitoring and altering oxygen therapy accordingly

National Patient Safety Agency Rapid Response Report – September 2009

The NPSA issued a Rapid response Report in September 2009. They received 281 reports of serious incidents related to inappropriate administration and management of oxygen. Of these incidents, poor oxygen management appears to have caused nine patient deaths and may have contributed to a further 35 deaths.

Common themes identified from the review of these incidents

- **Prescribing:** failure to or wrongly prescribed
- **Monitoring:** patients not monitored, abnormal oxygen saturation levels not acted upon
- **Administration:** confusion of oxygen with medical compressed air, incorrect flow rates, inadvertent
- **Equipment:** empty cylinders, faulty and missing equipment
- **Disconnection** of supply

NPSA recommendations for every institution

- NPSA briefing sheets highlighting actions to minimise risks of oxygen therapy are immediately made available to all relevant staff.
- The use of oxygen cylinders is minimised
- Where the use of oxygen cylinders is unavoidable robust systems are in place to ensure reliable and adequate supplies, including checking and stocktaking of cylinders.
- The risks of confusing oxygen and medical compressed air are assessed and action plans developed
- Oxygen is prescribed in all situations in accordance with BTS guidelines (but note these do not cover critical care or children less than 16 years).
- In an emergency, oxygen should always be given immediately and documented later.
- Pulse oximetry is available in all locations where oxygen is used.
- A multidisciplinary group responsible for reviewing oxygen-related incidents, developing a local oxygen policy and a training programme.

University Hospital of Wales – adult services

UHW have implemented the following strategies to date

- Minimal oxygen cylinder use hospital wide.
- Governance strategies where use of oxygen cylinders is unavoidable hospital wide
- Education programme in adult services.
- Mandatory prescription of oxygen in adult services.
- Doctor and nurses training programme for effective prescription and monitoring of oxygen therapy in adult services.
- System of oxygen therapy governance for monitoring of oxygen related incidents.

Oxygen prescribing: The Noah's Ark Children's Hospital for Wales

This document has been developed by a multidisciplinary team of doctors, nurse and pharmacists. It accompanies the introduction of oxygen prescribing for children at Noah' Ark Children's Hospital for Wales, Cardiff, and the inclusion of an oxygen section on the new All-Wales Paediatric Prescription Chart.

The document concentrates on implementing safe prescription, monitoring and titration of oxygen therapy in paediatric inpatients. It will need to be reviewed with reference to the BTS Guidelines for the Emergency Management of Oxygen Therapy in Children, when this document has been published.

Oxygen delivery systems

Oxygen is delivered to children on the ward through many different interfaces. These include nasal cannulae, facemask, headbox oxygen, non-rebreathe mask, CPAP, SIPAP, BIPAP, and high flow humidified oxygen systems (Vapotherm, Optiflow).

It is important to realise that for almost all of these systems, the amount of oxygen delivered to the lungs cannot be quantified as these are open systems where the patient can in-train surrounding air into the oxygen supply being delivered. This is called *uncontrolled oxygen therapy*. The exception is headbox oxygen where the %FiO₂ in the child's immediate environment can be accurately controlled. This is an example of *controlled oxygen therapy*.

Is giving oxygen safe?

In adults with chronic respiratory disease and CO₂ retention, respiratory drive may be dependent on hypoxia. Giving oxygen to these patients may cause CO₂ retention (CO₂ narcosis).

These adult patients are managed with regular blood gases and lower target oxygen saturations. Children with chronic respiratory disease may also have CO₂ retention.

In theory, children may also be at risk of CO₂ narcosis but this is extremely rare in the paediatric population. It is possible in patients who have CO₂ retention from chronic lung disease, so pay particular attention to children with chronic lung disease of prematurity, end stage cystic fibrosis, neuromuscular weakness and obesity when prescribing oxygen. If in doubt talk to your consultant.

Emergency oxygen

In any emergency, oxygen may still be administered without a prescription. The prescription will need to be written retrospectively.

Target oxygen saturations

In general, oxygen is delivered to children to achieve specific target oxygen saturations. Different disease guidelines stipulate different thresholds and there is currently little consensus. Flowsheet guidelines are given in Appendix A

- Target saturations for most children are defined at >92%.
- Target saturations for children with chronic lung disease of prematurity are defined at 91-94%
- Children with pulmonary hypertension should have oxygen saturations maintained above 95%.
- Children with congenital heart disease and blood mixing may have low oxygen saturations at baseline, and advice should be sought from the cardiology team with regard to target saturations in these patients

Prescribing oxygen

Oxygen is regarded as a medicine and therefore cannot be administered by nursing staff without a prescription. ***This is a legal requirement.***

The oxygen prescription chart has been designed to accommodate the following needs:

- Formalise oxygen delivery
- Maintain adequate flexibility so that nurses can continue to titrate oxygen appropriately without the restriction of needing to modify the prescription many times a day.
- Set the upper limit to the amount of oxygen that may be delivered before repeat medical reassessment is indicated. These limits are designed to precipitate a request for further medical consultation before oxygen therapy can be escalated.
- The oxygen chart must be able to accommodate multiple modifications in oxygen prescription in keeping with the changing condition of the child

The oxygen prescription is explicit in the following

- Target oxygen saturation
- Mode of oxygen delivery
- A range in the amount of oxygen that may be safely delivered to achieve the desired oxygen saturations.

Oxygen section in All Wales Paediatric Drug Chart

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES				MONTH		YEAR		
DATE										
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device	L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)							
Prescriber's Signature		Nasal cannula	0.01-1 L/min	<input type="checkbox"/>	1-2 L/min	<input type="checkbox"/>				
bleep No.		Headbox oxygen	<40%	<input type="checkbox"/>	40-60%	<input type="checkbox"/>				
Target Saturations (please circle)		Facemask	6-10 L/min	<input type="checkbox"/>	10-15 L/min	<input type="checkbox"/>				
		Mask with reservoir bag (for high O ₂ %)	10-15 L/min	<input type="checkbox"/>						
		Other device.....								
NURSE CHECK ↓										
>92%		MORNING								
>95%		MIDDAY								
Other		EVENING								
		BEDTIME								
									RE-WRITE CHART	

Oxygen monitoring by nursing staff

Drug chart

- Oxygen is a prescription only medication (POM).
- Nurses should use the time grid on the drug chart to double sign for the oxygen prescription 4 times/day

Observation chart

- A minimum of 4 hourly observations should be carried out. These are documented on the observation chart and should include:
 - Respiratory rate
 - Oxygen saturations
 - Level of oxygen administered
 - Mode of oxygen delivery*

Titrating oxygen therapy

- Nurses should always administer the minimum oxygen possible to achieve the desired oxygen saturations.
- Oxygen saturations should be monitored and documented 5 minutes after every change
- If the oxygen delivered reaches the upper extreme in the range prescribed, and oxygen saturations are still below the desired range, then a medical review should be requested. Oxygen can always be given in the acute situation to achieve the desired oxygen saturations without a prescription.

Stopping Oxygen therapy

- Oxygen therapy may be discontinued when oxygen saturations have been stable on minimal oxygen therapy for two consecutive observations.
- *Note: Oxygen may still be required at night and with feeding*

How to stop oxygen therapy

- Stop oxygen & monitor oxygen saturations for 5 minutes
- If stable, continue to monitor in air for 1 hour
- If oxygen saturations falls, then re-start oxygen
- If oxygen saturations remain stable at one hour, stay in air
- Document the changes you make
- Doctor should review and cross off oxygen on drug chart

*new requirement

Doctor and nurse responsibilities

DOCTORS

Prescribe oxygen

Target saturations

Device

Oxygen delivery limits

Sign drug chart

Review withdrawal of oxygen

Cross off oxygen on drug chart

NURSES

Start oxygen

achieve target straight away

Monitor oxygen

minimum 4 hourly.

Titrate and wean off oxygen

Always give the minimum oxygen required

Record

O₂ Sats, RR, O₂ delivery, delivery device

Sign drug chart every drug round

Document all changes in oxygen requirement

Inform doctors

If limits to oxygen prescription are reached

How to fill in the oxygen prescription chart

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES				MONTH				YEAR					
		DATE													
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device		L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)											
		Nasal cannula		0.01-1 L/min		<input type="checkbox"/>		1-2 L/min		<input type="checkbox"/>					
		Headbox oxygen		<40%		<input type="checkbox"/>		40-60%		<input type="checkbox"/>					
		Facemask		6-10 L/min		<input type="checkbox"/>		10-15 L/min		<input type="checkbox"/>					
		Mask with reservoir bag (for high O ₂ %)		10-15 L/min		<input type="checkbox"/>									
Prescriber's Signature bleep No.		Other device.....		<input type="checkbox"/>											
Target Saturations (please circle)		NURSE CHECK ↓										RE-WRITE CHART			
>92%		MORNING													
>95%		MIDDAY													
Other		EVENING													
		BEDTIME													

Example scenario

9 month child; bronchiolitis

Doctor's initial prescription

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES				MONTH <i>July</i>				YEAR <i>2014</i>					
		DATE	<i>11</i>												
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device		L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)											
		Nasal cannula		0.01-1 L/min		<input checked="" type="checkbox"/>		<i>0f 11/7/14</i>		1-2 L/min		<input type="checkbox"/>			
		Headbox oxygen		<40%		<input checked="" type="checkbox"/>		<i>0f 11/7/14</i>		40-60%		<input type="checkbox"/>			
		Facemask		6-10 L/min		<input type="checkbox"/>				10-15 L/min		<input type="checkbox"/>			
		Mask with reservoir bag (for high O ₂ %)		10-15 L/min		<input type="checkbox"/>									
Prescriber's Signature bleep No. <i>Jforton 1234</i>		Other device.....		<input type="checkbox"/>											
Target Saturations (please circle)		NURSE CHECK ↓										RE-WRITE CHART			
<i>>92%</i>		MORNING													
>95%		MIDDAY													
Other		EVENING													
		BEDTIME													

Nurse documentation

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES				MONTH <i>July</i>				YEAR <i>2014</i>					
		DATE	<i>11</i>	<i>12</i>											
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device		L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)											
		Nasal cannula		0.01-1 L/min		<input checked="" type="checkbox"/>		<i>0f 11/7/14</i>		1-2 L/min		<input type="checkbox"/>			
		Headbox oxygen		<40%		<input checked="" type="checkbox"/>		<i>0f 11/7/14</i>		40-60%		<input type="checkbox"/>			
		Facemask		6-10 L/min		<input type="checkbox"/>				10-15 L/min		<input type="checkbox"/>			
		Mask with reservoir bag (for high O ₂ %)		10-15 L/min		<input type="checkbox"/>									
Prescriber's Signature bleep No. <i>Jforton 1234</i>		Other device.....		<input type="checkbox"/>											
Target Saturations (please circle)		NURSE CHECK ↓										RE-WRITE CHART			
<i>>92%</i>		MORNING		<i>/ BW/TF</i>											
>95%		MIDDAY		<i>PS/AT SH/SL</i>											
Other		EVENING		<i>PS/AT</i>											
		BEDTIME		<i>BW/TF</i>											

Clinical deterioration day 3

Nurse contacts doctor

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES			MONTH <i>July</i>				YEAR <i>2014</i>						
		DATE	11	12	13										
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device		L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)											
Prescriber's Signature bleep No. <i>Jforston 1234</i>		Nasal cannula		0.01-1 L/min		<input checked="" type="checkbox"/>		<i>Jf 11/7/14</i>		1-2 L/min		<input type="checkbox"/>			
		Headbox oxygen		<40%		<input checked="" type="checkbox"/>		<i>Jf 11/7/14</i>		40-60%		<input type="checkbox"/>			
		Facemask		6-10 L/min		<input type="checkbox"/>				10-15 L/min		<input type="checkbox"/>			
		Mask with reservoir bag (for high O ₂ %)		10-15 L/min		<input type="checkbox"/>						<input type="checkbox"/>			
		Other device.....				<input type="checkbox"/>						<input type="checkbox"/>			
Target Saturations (please circle)		NURSE CHECK ↓												RE-WRITE	CHART
>92%		MORNING		/		BW/TF		BW/TF							
>95%		MIDDAY		PS/AT		SH/SL		SH/SL							
Other		EVENING		PS/AT		SH/SL									
		BEDTIME		BW/TF		BW/TF									

Doctor makes clinical assessment and increases oxygen prescription

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES			MONTH <i>July</i>				YEAR <i>2014</i>						
		DATE	11	12	13										
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device		L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)											
Prescriber's Signature bleep No. <i>Jforston 1234</i>		Nasal cannula		0.01-1 L/min		<input checked="" type="checkbox"/>		<i>Jf 11/7/14</i>		1-2 L/min		<input checked="" type="checkbox"/>		<i>PK 13/7/2014</i>	
		Headbox oxygen		<40%		<input checked="" type="checkbox"/>		<i>Jf 11/7/14</i>		40-60%		<input checked="" type="checkbox"/>		<i>PK 13/7/2014</i>	
		Facemask		6-10 L/min		<input type="checkbox"/>				10-15 L/min		<input type="checkbox"/>			
		Mask with reservoir bag (for high O ₂ %)		10-15 L/min		<input type="checkbox"/>						<input type="checkbox"/>			
		Other device.....				<input type="checkbox"/>						<input type="checkbox"/>			
Target Saturations (please circle)		NURSE CHECK ↓												RE-WRITE	CHART
>92%		MORNING		/		BW/TF		BW/TF							
>95%		MIDDAY		PS/AT		SH/SL		SH/SL							
Other		EVENING		PS/AT		SH/SL									
		BEDTIME		BW/TF		BW/TF									

Clinical deterioration overnight

Nurse increases oxygen as needed to maintain oxygen saturations

Nurse contacts doctor

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES			MONTH <i>July</i>				YEAR <i>2014</i>						
		DATE	11	12	13										
MEDICINE OXYGEN sign all oxygen limit boxes that you tick		Device		L/min or % O ₂ , (you may select multiple devices and multiple oxygen limits)											
Prescriber's Signature bleep No. <i>Jforston 1234</i>		Nasal cannula		0.01-1 L/min		<input checked="" type="checkbox"/>		<i>Jf 11/7/14</i>		1-2 L/min		<input checked="" type="checkbox"/>		<i>PK 13/7/2014</i>	
		Headbox oxygen		<40%		<input checked="" type="checkbox"/>		<i>Jf 11/7/14</i>		40-60%		<input checked="" type="checkbox"/>		<i>PK 13/7/2014</i>	
		Facemask		6-10 L/min		<input type="checkbox"/>				10-15 L/min		<input type="checkbox"/>			
		Mask with reservoir bag (for high O ₂ %)		10-15 L/min		<input type="checkbox"/>						<input type="checkbox"/>			
		Other device.....				<input type="checkbox"/>						<input type="checkbox"/>			
Target Saturations (please circle)		NURSE CHECK ↓												RE-WRITE	CHART
>92%		MORNING		/		BW/TF		BW/TF							
>95%		MIDDAY		PS/AT		SH/SL		SH/SL							
Other		EVENING		PS/AT		SH/SL		SH/SL							
		BEDTIME		BW/TF		BW/TF		BW/TF							

Doctor makes clinical assessment and increases oxygen prescription

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES				MONTH	YEAR					
		DATE	11	12	13	14	July 2014					
MEDICINE OXYGEN sign all oxygen limit boxes that you tick Prescriber's Signature bleep No. <i>Jforton 1234</i>	Device		L/min or % O ₂ (you may select multiple devices and multiple oxygen limits)									
	Nasal cannula		0.01-1 L/min	<input checked="" type="checkbox"/>	<i>JF 11/7/14</i>	1-2 L/min	<input checked="" type="checkbox"/>	<i>PK 13/7/2014</i>				
	Headbox oxygen		<40%	<input checked="" type="checkbox"/>	<i>JF 11/7/14</i>	40-60%	<input checked="" type="checkbox"/>	<i>PK 13/7/2014</i>				
	Facemask		6-10 L/min	<input type="checkbox"/>		10-15 L/min	<input type="checkbox"/>					
	Mask with reservoir bag (for high O ₂ %)		10-15 L/min	<input checked="" type="checkbox"/>	<i>EZ 14/7/2014</i>		<input type="checkbox"/>					
Other device.....			<input type="checkbox"/>			<input type="checkbox"/>						
Target Saturations (please circle)	NURSE CHECK ↓											RE-WRITE CHART
>92%	MORNING	/	BW/TF	BW/TF								
>95%	MIDDAY	PS/AT	SH/SL	SH/SL								
	EVENING	PS/AT	SH/SL	SH/SL								
Other	BEDTIME	BW/TF	BW/TF	BW/TF								

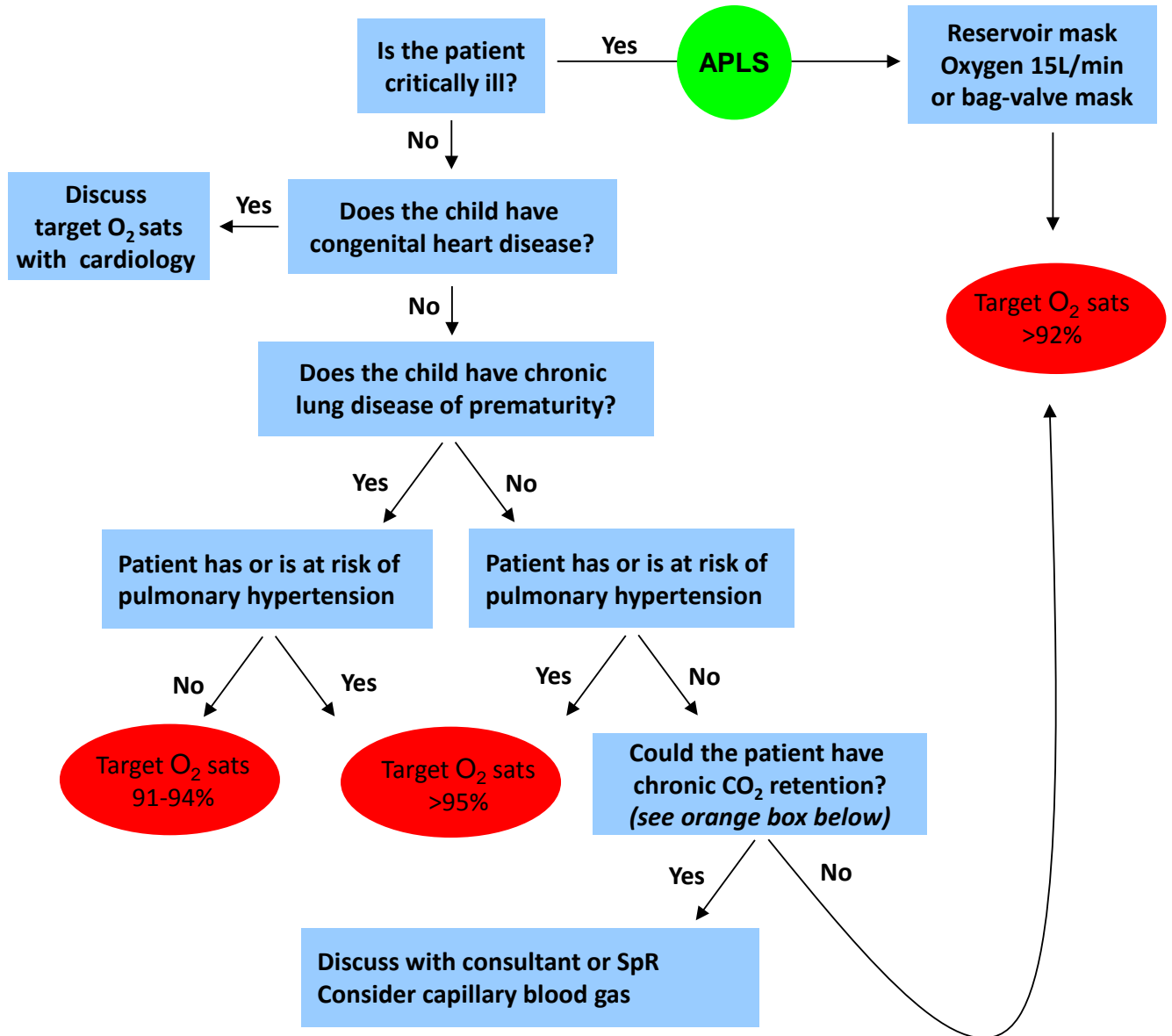
Child transferred to HDU

Child started on nCPAP with 10L/min O₂

ENTER DOSE AGAINST TIME REQUIRED. USE ONE ROUTE ONLY FOR EACH ENTRY		REGULAR MEDICINES				MONTH	YEAR					
		DATE	11	12	13	14	July 2014					
MEDICINE OXYGEN sign all oxygen limit boxes that you tick Prescriber's Signature bleep No. <i>Jforton 1234</i>	Device		L/min or % O ₂ (you may select multiple devices and multiple oxygen limits)									
	Nasal cannula		0.01-1 L/min	<input checked="" type="checkbox"/>	<i>JF 11/7/14</i>	1-2 L/min	<input checked="" type="checkbox"/>	<i>PK 13/7/2014</i>				
	Headbox oxygen		<40%	<input checked="" type="checkbox"/>	<i>JF 11/7/14</i>	40-60%	<input checked="" type="checkbox"/>	<i>PK 13/7/2014</i>				
	Facemask		6-10 L/min	<input type="checkbox"/>		10-15 L/min	<input type="checkbox"/>					
	Mask with reservoir bag (for high O ₂ %)		10-15 L/min	<input checked="" type="checkbox"/>	<i>EZ 14/7/2014</i>		<input checked="" type="checkbox"/>	<i>PF 14/7/2014</i>				
Other device... <i>Nasal CPAP</i>			<input checked="" type="checkbox"/>	<i>10L/minute</i>		<input type="checkbox"/>						
Target Saturations (please circle)	NURSE CHECK ↓											RE-WRITE CHART
>92%	MORNING	/	BW/TF	BW/TF	GW/TY							
>95%	MIDDAY	PS/AT	SH/SL	SH/SL								
	EVENING	PS/AT	SH/SL	SH/SL								
Other	BEDTIME	BW/TF	BW/TF	BW/TF								

Appendix A: Guidance on target oxygen saturation levels

EMERGENCY OXYGEN PRESCRIBING PAEDIATRIC GUIDELINES IN SECONDARY CARE



Breathing in patients who have chronic CO₂ retention may be dependant on hypoxic drive

Take care with oxygen in the following patients

- Chronic lung disease of prematurity
- Neuromuscular disease
- Obesity
- End stage cystic fibrosis

Oxygen must be prescribed in the drug chart using the paediatric oxygen sticker

In an emergency, oxygen can be given without a prescription

Appendix B: Guidance on oxygen delivery interfaces in children

Guidance on oxygen delivery interfaces in children

DEVICE/FiO ₂	INDICATIONS	ADVANTAGES	LIMITATIONS
<p>Headbox</p> <p>Humidified and warmed O₂ 24-60%</p>	<p>Suitable for infants and small children with acute episodes of respiratory illness eg bronchiolitis</p>	<ul style="list-style-type: none"> Controlled oxygen delivery Well tolerated in infants Easy delivery of humidified O₂ 	<ul style="list-style-type: none"> CO₂ build up may occur if flow <7l/min OR outflow from box is obstructed. O₂ needs to be warmed for smaller infants as the environment inside can become cold Access to give care can cause significant fall in oxygen delivered
<p>Nasal cannulae</p> <p>Maximum flow rate 2l/min</p> <p>Estimated oxygen delivery 24-40%</p>	<ul style="list-style-type: none"> Long Term Oxygen Therapy (LTOT). Minimal oxygen requirement Recovery phase from acute episodes 	<ul style="list-style-type: none"> Low cost and easy for patient to eat and talk well tolerated No re-breathing. 	<ul style="list-style-type: none"> Uncontrolled oxygen delivery Oxygen delivery is affected by flow setting, respiratory rate, depth of breathing and geometry of nose. Dries the nose, can cause headaches.
<p>Facemask</p> <p>5-15 litres/min</p> <p>Estimated oxygen delivery 40-60%</p>	<ul style="list-style-type: none"> Use for patients who need high oxygen delivery 	<p>Useful in children who</p> <ul style="list-style-type: none"> are mouth breathers have nasal irritation have epistaxis 	<ul style="list-style-type: none"> Minimum delivery 5litres/min to avoid rebreathing of expired CO₂. Oxygen delivery is affected by flow setting, mask fitting, mask leak and patient's breathing pattern.
<p>Non re-breathe mask</p> <p>6 -15 litres/min</p> <p>Estimated oxygen delivery 60-100%</p>	<p>Often used in APLS setting</p> <p>(trauma, shock, severe asthma, convulsions, reduced level of consciousness)</p>	<p>Delivers very high concentrations of oxygen</p>	<ul style="list-style-type: none"> Minimum delivery 6 litres/min to avoid rebreathing of expired CO₂. Oxygen delivery is affected by mask fitting and mask leak

26/6/2012

Dr Julian Forton. Consultant in paediatric respiratory medicine